

STRUCTURE OF VAPOR DEPOSITED SOLID HYDROGEN CRYSTALS*

Gilbert Collins, Evan Mapoles, Walt Unites and Tom Bernat

University of California
Lawrence Livermore National Laboratory
P.O. Box 808, Livermore, CA 94551

Solid hydrogen crystals grown slowly through the liquid phase can easily be made several millimeters in extent with flat crystal facets. This tendency to form large crystals with facets makes it difficult to form smooth spherical hydrogen layers for ICF targets. Two ways to prevent large incommensurate facets is to make very small hydrogen crystallites or grow crystals above roughening temperatures.

One way to reduce crystal size is to deposit crystals at low temperature. We report the crystal size and crystal structure of solid hydrogen deposited from the gas phase from the triple point temperature, T_{tp} , down to 3 K. H_2 and D_2 crystals deposited near T_{tp} are millimeter in extent with HCP crystal structure. For deposition temperatures $T_d < 0.4 T_{tp}$, microcrystals are formed with a mixed HCP+FCC crystal phase. This mixed phase transforms into an HCP phase continuously and irreversibly as the temperature increases through $0.5 T_{tp}$. During this crystal structure transformation the crystallite size increases. Finally we show that flat crystal facets in hydrogen are more stable than previously anticipated. For current NIF target designs, hydrogen crystals near equilibrium will contain facets.

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